

DEFENDING DOC

By John Albanese

This article seeks to validate the stroke mechanics studies of famed Coach James "Doc" Counsilman, which were critiqued in last month's newsletter "*Changing Your Stroke*". I will preface this by saying at the club level I was trained by one of Doc's top disciples, ASCA Hall of Fame Coach John Collins, and I also had the privilege of competing against Doc and his Indiana University team, while a member of the University of Michigan Swim Team in the early 1980's. For purposes of this article, I will focus on the mechanics of the "crawl stroke", as it is referred to in swimming's Bible, *The Science of Swimming* by James E. Counsilman and the book's successive editions.

BERNOULLI'S PRINCIPLE

Doc's references to "the Bernoulli effect" explain how the Wright Brothers got off the ground and why North Carolina now has "First in Flight" license plates. It also explains why our boat propellers work here in Eastern Carolina. This concept is the key to understanding the physics behind all swimming stroke mechanics.

Simply stated: High pressure and compression of water molecules on one side of the swimmer's pulling arm, and the resultant lower pressure on the opposite side, creates a propulsive force.

"Bernoulli's principle can also be derived directly from Newton's 2nd law. If a small volume of fluid is flowing horizontally from a region of high pressure to a region of low pressure, then there is more pressure behind than in front. This gives a net force on the volume, accelerating it along the streamline" http://en.wikipedia.org/wiki/Bernoulli%27s_principle

However, this difference in water pressure is short lived and quickly dissipates once the water is set into motion, so the swimmer must continuously find "new water" to maintain maximum propulsive force. This is why your coach is (or should be) having you perform sculling drills, so you can feel that difference in the water pressure.

If you continue to pull water that is already moving in a straight line, you'll lose that pressure force. All strokes incorporate curved or elliptical pull patterns, which seek new, still water to gain that leverage. The best swimmers possess an innate "feel of the water", whereby they have the proprioception enabling them to sense this difference in water pressure to find their maximum leverage.

"S" or STRAIGHT LINE PULL?

Counsilman proved that all pull patterns follow curved "S" like patterns, to take advantage of the Bernoulli Principle. Doc didn't invent "S" curve stroke mechanics, as was alleged in last month's article. Rather, he observed them when analyzing some of the greatest natural swimmers of his era. Then he reverse engineered his findings into the stroke mechanics cited in his book.

Last month's article overlooked this passage in Counsilman's work:

"When (Mark Spitz) came to me as a freshman in college, he held two world records and had near-perfect stroke mechanics. When I asked him how he pulled his hands on the crawl stroke, he gave me a detailed description of a nearly straight elbow pull down the middle line of the body." *Competitive Swimming Manual for Coaches and Swimmers*, by James E. Counsilman 1977 edition at page 133.

This description by Doc's top pupil is strikingly similar the "new" stroke mechanics professed by the author in last month's article.

Both these passages seem to contradict the Hall of Fame coach from Indiana.

So who was right, the coach or the athlete? And where did the "S" curve come from?

DOC WAS RIGHT!

Doc's experiment took Mark Spitz amongst other great swimmers of his day, and put reflector tape on their kinetic check points. Then he turned the pool lights out and photographed them in the dark with an underwater camera and a strobe light, thus creating tracer patterns on the film. This was cutting edge technology for its day.

"Underwater movies of (Mark Spitz's) pull show him to be using a zigzag pull with his elbows bending up to almost 90 degrees." Competitive Swimming Manual for Coaches and Swimmers, by James E Counsilman 1977 edition at page 133. Also see The New Science of Swimming, by James E. Counsilman and Brian E. Counsilman 1994 edition at pages 23-25

The result: "S" DEFINITELY HAPPENS!

Despite what Mark Spitz thought he was doing, the tracer lights on the photographs showed curved elliptical patterns, thus proving his arm pull followed the elliptical "S" curve. And I guarantee you, if take any world class freestyler today and do the same strobe light experiment, these same curved patterns will appear.

IT IS A MATTER OF PERCEPTION FROM A POINT OF REFERENCE

Now that you're thoroughly confused, you may ask, "How can all be this be reconciled?!"

It's all a matter of your point of reference. Imagine the swimmer is sitting in a train at the station, looking out the window, while there is second train on the other tracks. The swimmer thinks his train is pulling out, but the swim coach on the platform sees that it is the other train that is actually moving.

The swimmer's psyche, with nothing to look at but that black line on the bottom, tends to see this from a 2 dimensional perspective. However, Coach Counsilman, with the benefit of that aquarium window at the bottom of the famed Indiana pool, saw it from a moving three dimensional perspective.

From the swimmer's perspective, the arm must pull in a straight line down the mid-line of the body just as Mark Spitz and last month's author described. The swimmer's proprioceptive sense of trying to straighten the elbow comes from their countering the temptation to follow the path of least resistance and drop the elbow (which we all must agree is a common stroke defect).

However, from the coach's perspective, the swimmer's body is (or should be) rotating side to side. And just like Doc, from underwater you'll observe any modern world class freestyler bending their elbow to a certain degree.

It is the swimmer's body rotation and elbow bend, which converts the "straight line" arm pull into an "S" curve, thus taking full advantage of Bernoulli's principle. This is why your coach is (or should be) teaching side kicking, side kick-switch, and other body rotation drills.

Final note: Doc's crawl stroke mechanics are still used by most top level swimmers today, and have passed the test of time. The exception would be the minority of freestylers who utilize that short, wide High Anchor Elbow technique, which is popular with many European sprinters, amongst others. However, Doc documented that technique while critiquing the stroke of Kornelia Ender. *Competitive Swimming Manual for Coaches and Swimmers*, by James E Counsilman 1977 edition at page 153. Also see *The New Science of Swimming*, by James E. Counsilman and Brian E. Counsilman 1994 edition at pages 50-51. You'll observe the same elliptical curved pattern with that technique, only it will be shorter. And one final word of advice, if you use the high anchor elbow technique, be careful with your shoulder, since that style can put a lot of strain on your rotator cuff.

CONCLUSION

To paraphrase Coach Collins, Counsilman's contributions to swimming were monumental. Beyond just stroke mechanics, he changed the way the sport was perceived. His teachings revolutionized the way athletes were trained in a wide variety of sports. Doc was the first swim coach to recognize that change is necessary. Granted, there are new theories on stroke mechanics out there, and some are valid. However, we didn't erase Albert Einstein from the physics books once Stephen Hawking came around, and similarly, it would be foolish to dismiss Doc's body of work. Indiana University's Head Coach Dr. James E. Counsilman was an innovative pioneer and the greatest coach in the history of swimming.

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